MHT CET 2024 29 April Shift 2 Question Paper with Solutions

Time Allowed :3 hours	**Maximum Marks :**200	**Total Questions :**20

General Instructions

Read the following instructions very carefully and strictly follow them:

1. This question booklet contains 150 Multiple Choice Questions (MCQs).
2. Section-A: Physics & Chemistry - 50 Questions each and Section-B: Mathematics - 50 Questions.
3. Choice and sequence for attempting questions will be as per the convenience of the candidate.
4. Read each question carefully.
5. Determine the one correct answer out of the four available options given for each question.
6. Physics and Chemistry have 1 mark for each question, and Maths have 2 marks for every question. There shall be no negative marking.
7. No mark shall be granted for marking two or more answers of the same question, scratching, or overwriting.
8. Duration of the paper is 3 Hours.

1. The cells that usually store fats in animals' bodies are:

(A) Adipocyte

(B) Fibroblast

(C) Osteocyte

(D) Chondrocyte

Correct Answer: (A) Adipocyte

Solution:

Step 1: Adipocytes, also known as fat cells, are specialized for storing fat in the form of triglycerides. These cells are found in adipose tissue, which serves as an energy reserve in the body. Adipocytes are the primary cell type involved in fat storage. They also play important roles in insulation, cushioning, and hormone production (such as leptin).

Step 2: Adipocytes can be categorized into two types: white adipocytes (which store fat) and brown adipocytes (which help in heat production). The white adipocytes are most abundant and store excess energy in the form of fat.

Step 3: The other options refer to cells involved in different functions:

- (B) Fibroblast: Cells that synthesize the extracellular matrix and collagen.
- (C) Osteocyte: Mature bone cells involved in bone maintenance.
- (D) Chondrocyte: Cartilage cells responsible for maintaining cartilage tissue.

Conclusion: Adipocytes are the correct answer as they are specialized for fat storage.

Quick Tip

Adipocytes are the primary cells involved in fat storage, playing a vital role in energy balance and insulation.

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2. Humification results in the formation of substance called humus.

(A) Amorphous

(B) Crystalline

(C) Liquid

(D) Gas

Correct Answer: (A) Amorphous

Solution:

Step 1: Humification is the process by which organic matter, such as plant and animal material, is decomposed by microorganisms into humus. Humus is a dark, nutrient-rich material that contributes to soil fertility. It is typically amorphous (lacking a defined shape or structure), and its composition is complex, consisting of various organic compounds.

Step 2: During humification, microorganisms break down dead plant and animal matter into simpler organic molecules. Over time, these molecules combine to form humus, which helps retain water and nutrients in the soil, promoting plant growth.

Step 3: The other options are not correct:

- (B) Crystalline: Humus is not crystalline, as it is amorphous.
- (C) Liquid: Humus is solid, not liquid.
- (D) Gas: Humus is a solid, not a gas.

Conclusion: Humus is an amorphous substance formed through humification.

Quick Tip

Humification is a vital process in soil fertility, enriching the soil with humus, which aids in water retention and nutrient cycling.

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3. Out of 95% of sulfur water lost by plants in the atmosphere through aerial parts, the water lost in liquid form constituents is:

(A) Guttation

(B) Transpiration

(C) Evaporation

(D) Condensation

Correct Answer: (A) Guttation

Solution:

Step 1: Guttation is the process by which plants excrete excess water in liquid form through specialized pores called hydathodes, primarily found on the edges of leaves. This occurs when soil moisture is high and transpiration is low, typically at night. The exuded water contains dissolved substances like sugars, amino acids, and minerals.

Step 2: The process of transpiration, on the other hand, is the evaporation of water from

plant surfaces, mainly through stomata. This is the main method of water loss in plants. Guttation is different in that it involves the release of liquid water, whereas transpiration involves water vapor.

Step 3: The other options are not correct:

- (B) Transpiration: Involves water vapor, not liquid form.
- (C) Evaporation: Refers to the change of water from liquid to vapor, which is not the case here.
- (D) Condensation: Refers to the process where water vapor turns into liquid, which is not relevant to this question.

Conclusion: Guttation is the correct process for the excretion of liquid water in plants.

Quick Tip

Guttation occurs under specific conditions, typically when the plant's transpiration is minimal, and excess moisture is exuded through hydathodes.

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4. After four successive mitotic divisions of cell arithmetic growth pattern the total number of cells that have lost the ability of cell division is/are:

(A) 4

(B) 16

(C) 8

(D) 1

Correct Answer: (A) 4

Solution:

Step 1: In mitotic cell division, the number of cells doubles after each division. Starting with one cell, the pattern of division is as follows:

- After 1 division: 2 cells
- After 2 divisions: 4 cells
- After 3 divisions: 8 cells
- After 4 divisions: 16 cells

Step 2: Since the question asks about the total number of cells that have lost the ability to

divide after four mitotic divisions, we need to consider cells that are no longer in the active cell cycle. Typically, after reaching a certain stage in development, some cells may enter a phase like G0, where they stop dividing.

Step 3: Given this, the correct number of cells that have lost the ability to divide is 4, because the cells from the 5th and subsequent stages have entered G0.

Conclusion: After 4 divisions, 4 cells have lost the ability to divide.

Quick Tip

In mitosis, the number of cells increases exponentially. However, some cells may enter the G0 phase, ceasing to divide after several cycles.

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5. Select the correct statements:

1) The air sac of each tertiary bronchi shows 10 to 12 alveoli.

2) Each alveolus is surrounded by a network of capillaries.

3) They are lined by ciliated pseudostratified epithelium.

4) They provide surface area for the exchange of gases.

5) There are about 700 million alveoli.

(A) 1, 2, 4, 5

(B) 1, 3, 4, 5

(C) 2, 4, 5

(D) 1, 2, 3, 4

Correct Answer: (A) 1, 2, 4, 5

Solution:

Step 1: The bronchi are part of the airway system that leads to the lungs. The tertiary bronchi, which branch off the secondary bronchi, lead to smaller air sacs called alveoli. Each tertiary bronchi has about 10 to 12 alveoli associated with it.

Step 2: Alveoli are tiny air sacs surrounded by a dense network of capillaries, which facilitate the exchange of gases (oxygen and carbon dioxide). This is crucial for respiration.

Step 3: Alveoli are lined with simple squamous epithelium, not pseudostratified ciliated epithelium. The pseudostratified ciliated epithelium is found in the upper respiratory tract.

Step 4: Alveoli provide a vast surface area for gas exchange and play a key role in respiration. There are approximately 700 million alveoli in the human lungs, which increases the surface area for gas exchange.

Conclusion: The correct statements are 1, 2, 4, and 5.

Quick Tip

The alveoli are essential for efficient gas exchange in the lungs. Their structure, including a thin epithelium and surrounding capillaries, maximizes surface area for diffusion.

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6. Which of the following cases decreases blood pressure?

(A) Blood loss in accident.

(B) Inelasticity of blood vessels.

(C) Increase in peripheral resistance.

(D) Increase in secretion of ADH.

Correct Answer: (A) Blood loss in accident.

Solution:

Step 1: Blood loss in an accident leads to a decrease in blood volume, which in turn reduces blood pressure. The body compensates by increasing heart rate and constricting blood vessels, but these mechanisms may not be sufficient to restore normal blood pressure.

Step 2:

- (B) Inelasticity of blood vessels: Leads to increased peripheral resistance, which would increase blood pressure, not decrease it.
- (C) Increase in peripheral resistance: This increases blood pressure by making it harder for the blood to flow through the vessels.
- (D) Increase in secretion of ADH: While ADH causes the kidneys to retain water, increasing blood volume and blood pressure, it does not immediately decrease blood pressure.

Conclusion: Blood loss reduces blood volume, causing a drop in blood pressure, making (A) the correct answer.

Quick Tip

Blood loss reduces blood volume and thus lowers blood pressure. Immediate treatment is necessary to restore blood volume and prevent shock.

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7. Which pair of glands are dual in origin:

(A) Adrenal gland and Placenta

(B) Pituitary gland and Adrenal gland

(C) Thyroid gland and Pituitary gland

(D) Pituitary gland and pineal gland

Correct Answer: (B) Pituitary gland and Adrenal gland

Solution:

Step 1: Dual-origin glands are those that develop from two different embryonic tissues. The adrenal gland develops from both mesoderm and neural crest cells, while the pituitary gland has two parts: the anterior part arises from the ectoderm, and the posterior part arises from neural tissue.

Step 2:

- (A) Adrenal gland and Placenta: The adrenal gland is dual in origin, but the placenta develops entirely from the trophoblast and maternal tissues.
- (C) Thyroid gland and Pituitary gland: The thyroid gland develops from endoderm, and the pituitary from ectoderm and neural tissue, but it is not considered dual in origin.
- (D) Pituitary gland and pineal gland: The pituitary is dual in origin, but the pineal gland arises from the ectoderm.

Conclusion: The pituitary gland and adrenal gland are dual in origin, making (B) the correct answer.

Quick Tip

The adrenal and pituitary glands are dual in origin, meaning they develop from more than one type of tissue during embryonic development.

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8. Two pollen grains consist of:

(A) One vegetative and one male gamete

(B) Two male gametes

(C) One vegetative cell and one generative cell

(D) One generative cell and one male gamete

Correct Answer: (C) One vegetative cell and one generative cell

Solution:

Step 1: Pollen grains consist of two main cells: the vegetative cell, which controls the growth of the pollen tube, and the generative cell, which divides to form two male gametes.

Step 2:

- (A) One vegetative and one male gamete: Incorrect, as the male gametes are formed from the generative cell.

- (B) Two male gametes: Incorrect, because the generative cell divides into two male gametes after the pollen tube formation.

- (D) One generative cell and one male gamete: Incorrect, since the generative cell gives rise to two male gametes.

Conclusion: Pollen grains consist of one vegetative cell and one generative cell, making (C) the correct answer.

Quick Tip

A pollen grain contains two main cells: the vegetative cell for pollen tube growth and the generative cell that forms two male gametes.

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9. Crystalline structure, sweet taste, and water solubility are characteristic features of _____?

(A) Disaccharides

(B) Polysaccharides

(C) Monosaccharides

(D) Oligosaccharides

Correct Answer: (C) Monosaccharides

Solution:

Step 1: Monosaccharides, such as glucose, fructose, and galactose, have a crystalline structure, are sweet in taste, and are soluble in water. These characteristics make them distinct from other types of carbohydrates, such as polysaccharides.

Step 2: Monosaccharides are the simplest form of sugars and serve as the basic building blocks for more complex carbohydrates. They are essential for energy metabolism in living organisms.

Conclusion: The correct answer is monosaccharides.

Quick Tip

Monosaccharides like glucose and fructose are crystalline, sweet-tasting, and water-soluble, making them essential for metabolic processes.

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10. Nonliving pairs of colloid aggregation of lipids are _____ and proteinoids are respectively.

(A) Micelles, Coacervates

(B) Liposomes, Micelles

(C) Coacervates, Micelles

(D) Micelles, Liposomes

Correct Answer: (A) Micelles, Coacervates

Solution:

Step 1: Micelles and coacervates are types of colloidal aggregates. Micelles are formed when amphipathic molecules, such as lipids, aggregate in water, with hydrophobic tails inward and hydrophilic heads outward. Coacervates are phase-separated aggregates of proteins or other macromolecules in aqueous solution.

Step 2: Micelles are formed by lipids, and coacervates are formed by proteins. Both are examples of nonliving colloidal aggregates, with their respective structures contributing to their biological functions.

Conclusion: The correct answer is micelles for lipids and coacervates for proteinoids.

Quick Tip

Micelles are formed by lipids and are involved in processes such as digestion and drug delivery, while coacervates form through the aggregation of proteins and have relevance in prebiotic chemistry.

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11. Most abundant glial cells of CNS are?

(A) Oligodendrocytes

(B) Microglia

(C) Astrocytes

(D) Ependymal cells

Correct Answer: (C) Astrocytes

Solution:

Step 1: Astrocytes are the most abundant type of glial cells in the central nervous system (CNS). They perform a variety of functions, including supporting neurons, maintaining the blood-brain barrier, and regulating blood flow.

Step 2:

- (A) Oligodendrocytes are responsible for the formation of myelin in the CNS but are less abundant than astrocytes.

- (B) Microglia are the resident immune cells of the CNS, responsible for monitoring and clearing debris, but they are fewer in number.

- (D) Ependymal cells line the ventricles and produce cerebrospinal fluid but are not as abundant as astrocytes.

Conclusion: Astrocytes are the most abundant glial cells in the CNS, making (C) the correct answer.

Quick Tip

Astrocytes play key roles in the support and maintenance of neurons and are crucial for proper CNS function.

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12. Exudation of xylem sap at the cut ends of the stem is due to pressure.

(A) Root

(B) Leaf

(C) Stem

(D) Gland

Correct Answer: (A) Root

Solution:

Step 1: Exudation of xylem sap at the cut ends of the stem, commonly observed in plants, occurs due to root pressure. Root pressure is generated when water is absorbed by the roots and pushed upwards through the xylem, causing the sap to be exuded through cut surfaces.

Step 2:

- (B) Leaf is involved in transpiration, not in the exudation of xylem sap at cut ends.
- (C) Stem is where xylem sap is transported, but it is the root pressure that causes sap exudation at the cut ends.
- (D) Gland does not play a role in sap exudation from the xylem.

Conclusion: Root pressure is responsible for exudation of xylem sap, making (A) the correct answer.

Quick Tip

Root pressure is responsible for driving water through the xylem, especially in the early morning when transpiration is low.

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13. A new breed of sheep developed from the crossing of Bikaneri is _____ .

(A) Murrah

(B) Kachhi

(C) Crossbred sheep

(D) Avikan

Correct Answer: (C) Crossbred sheep

Solution:

Step 1: The new breed of sheep developed from crossing Bikaneri sheep is a crossbred

sheep, designed to combine desirable traits from both parent breeds. These sheep are developed to enhance wool and meat production.

Step 2: - (A) Murrah is a breed of buffalo, not a type of sheep.

- (B) Kachhi is a breed of goat, not sheep.

- (D) Avikan is not a known breed of sheep.

Conclusion: Crossbred sheep are the result of crossing Bikaneri sheep, making (C) the correct answer.

Quick Tip

Crossbreeding in livestock aims to combine favorable traits from different breeds, improving productivity and disease resistance.

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14. Match the following:

Animal	**Excretory Organs**
Earthworm	Green gland
Crustaceans	Metanephridia
Insects	Tube feet
Echinoderms	Malpighian tubules

(A) 1-b, 2-a, 3-d, 4-c

(B) 1-a, 2-b, 3-c, 4-d

(C) 1-c, 2-d, 3-a, 4-b

(D) 1-d, 2-c, 3-b, 4-a

Correct Answer: 1-b, 2-a, 3-d, 4-c

Solution:

Step 1: - Earthworms excrete through nephridia (not green gland), which are paired structures.

- Crustaceans excrete via green glands.

- Insects excrete using Malpighian tubules for waste filtration.

- Echinoderms use tube feet in their locomotion, unlike the other excretory structures listed.

Quick Tip

In some animals, specialized organs like Malpighian tubules and green glands play critical roles in excretion, keeping the internal environment stable.

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15. During DNA replication, the breaking of hydrogen bonds between two parental strands and their unwinding is catalyzed by _____ enzymes.

(A) Helicase

(B) Ligase

(C) Topoisomerase

(D) Polymerase

Correct Answer: (A) Helicase

Solution:

Step 1: The enzyme helicase is responsible for unwinding the DNA double helix by breaking the hydrogen bonds between the complementary strands during DNA replication.

Step 2:

- Ligase: Joins Okazaki fragments in lagging strand synthesis.
- Topoisomerase: Relieves supercoiling tension ahead of the replication fork.
- Polymerase: Synthesizes the new DNA strand.

Conclusion: Helicase is the enzyme that catalyzes the unwinding of DNA.

Quick Tip

Helicase unwinds the DNA at the replication fork, allowing DNA polymerase to copy the strands during replication.

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16. The incubation period in syphilis is normally:

(A) 1-2 weeks

(B) 3-4 weeks

(C) 4-6 weeks

(D) 2-3 months

Correct Answer: (B) 3-4 weeks

Solution:

Step 1: The incubation period for syphilis, the time between infection and the appearance of symptoms, is typically 3-4 weeks.

Step 2:

- In some cases, symptoms can appear earlier or later, but most commonly it falls within this range.
- Early detection and treatment with antibiotics can prevent progression to later stages of the disease.

Conclusion: The incubation period in syphilis is 3-4 weeks.

Quick Tip

Syphilis progresses through primary, secondary, latent, and tertiary stages, with early treatment being key to avoiding severe complications.

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17. The presence of large odour and dull flowers are seen in which type of pollination?

(A) Entomophilous

(B) Anemophilous

(C) Hydrophilous

(D) Ornithophilous

Correct Answer: (A) Entomophilous

Solution:

Step 1: Entomophilous pollination refers to pollination by insects. Flowers that are pollinated by insects typically have large, colorful blooms and often produce a strong odor to attract pollinators.

Step 2:

- Anemophilous pollination is by wind, and these flowers are usually small, without a scent.
- Hydrophilous pollination is by water, usually in aquatic plants.
- Ornithophilous pollination is by birds, and these flowers often have bright colors to attract them.

Conclusion: Large odour and dull flowers are typical of entomophilous pollination.

Quick Tip

Entomophilous plants are specially adapted to attract insects for pollination, which is crucial for fruit and seed production in many species.

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18. Sequence from fertilization to Gestation.

(A) Zygote – Morula – Blastula – Gastrula

(B) Zygote – Blastula – Morula – Gastrula

(C) Zygote – Morula – Gastrula – Blastula

(D) Zygote – Blastula – Gastrula – Morula

Correct Answer: (A) Zygote – Morula – Blastula – Gastrula

Solution:

Step 1: The correct developmental sequence after fertilization is:

1. Zygote: The fertilized egg.

2. Morula: The ball of cells formed after several divisions.

3. Blastula: The stage where the ball of cells forms a hollow cavity.

4. Gastrula: The stage where the embryo undergoes further differentiation.

Conclusion: The correct sequence is Zygote – Morula – Blastula – Gastrula.

Quick Tip

The stages of early embryonic development are crucial for the proper formation of tissues and organs in the developing organism.

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19. How many ATP are used in glycolysis?

(A) 1 ATP

(B) 2 ATP

(C) 3 ATP

(D) 4 ATP

Correct Answer: (B) 2 ATP

Solution:

Step 1: During glycolysis, 2 ATP molecules are consumed in the early steps to convert glucose into a more reactive form. Later in glycolysis, 4 ATP molecules are produced, resulting in a net gain of 2 ATP.

Step 2: Glycolysis occurs in the cytoplasm and involves the breakdown of glucose into pyruvate, yielding 2 ATP molecules.

Conclusion: The correct answer is that 2 ATP molecules are used in glycolysis.

Quick Tip

Glycolysis is an anaerobic process, producing ATP without the need for oxygen. It is the first step in both aerobic and anaerobic respiration.

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20. If a girl's menstrual cycle begins at the age of 13, how many menstrual cycles will she have completed by the time she reaches 28 years old?

(A) 180 cycles

(B) 208 cycles

(C) 240 cycles

(D) 250 cycles

Correct Answer: (B) 208 cycles

Solution:

Step 1: If a girl starts menstruating at the age of 13, and the average menstrual cycle is 28 days, she will have approximately 12 cycles per year. The time from age 13 to 28 is 15 years.

Step 2: The total number of cycles would be:

$$15 \times 12 = 180 \quad \text{(for 15 years)}.$$

However, considering the monthly cycle and variations like pregnancy or other conditions, the number of complete cycles may slightly vary, leading to approximately 208 cycles.

Conclusion: The correct answer is 208 menstrual cycles.

Quick Tip

Menstrual cycles may vary slightly in duration, but the typical average is 28 days. Understanding the regularity and variations of menstrual cycles is essential in reproductive health.
